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IN RE APPLICATION OF: Toshiaki Takaoka et al.

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FOR: MOBILE COMMUNICATION TERMINAL DEVICE

TRANSLATION OF DOCUMENT

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SIR:

Kenji Kobayashi, a translator residing at 2-46-10, Gokonishi, Matsudo-shi, Chiba-ken, Japan, hereby states:

(1) that I know well both the Japanese and English languages;

(2) that I translated the attached document identified as corresponding to Patent Application No. **2000-124493** filed in Japan on **April 25, 2000** from Japanese to English;

(3) that the attached English translation is a true and accurate translation to the best of my knowledge and belief.

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[Title of the Invention] MOBILE COMMUNICATION TERMINAL

[What is claimed is:]

[Claim 1] A mobile communication terminal characterized by comprising:

one kind of external connector having a predetermined terminal arrangement structure;

a plurality of kinds of first external interfaces sending and receiving a signal to and from an external device in accordance with different protocols via the external connector;

first determination means for determining a type of a second external interface incorporated in the external device connected to the external connector; and

interface selecting means for selecting an external interface corresponding to the second external interface incorporated in the external device from the plurality of kinds of first external interfaces based on a determination result of the first determination means.

[Claim 2] The mobile communication terminal according to claim 1, characterized by further comprising:

second determination means for conducting an authentication procedure between the mobile communication terminal and an external device via the first external interface selected by the interface selecting means, and determines a connection status of the external device to the mobile communication terminal itself based on the

authentication result; and

connection control means for controlling a connection of the external device to the mobile communication terminal itself based on a determination result of the second determination means.

[Claim 3] The mobile communication terminal according to claim 1, characterized in that voltages output from specified terminals of a plurality of external devices which are assumed to be connected are set to be different values, and when an external device is connected to the external connector, the first determination means detects the value of the voltage output from the specified terminal of the external device via the corresponding terminal of the external connector, and determines the type of the second external interface incorporated in the external device based on the detection result.

[Claim 4] The mobile communication terminal according to claim 2, characterized in that the second determination means sends and receives a signal to and from the external device via the first external interface selected by the interface selecting means, thereby detecting a type and a specification of the external device, and determines whether or not the external device can be connected to the mobile communication terminal itself based on the detection result.

[Claim 5] The mobile communication terminal according to any one of claims 1 to 4, characterized by further

comprising display means for displaying at least one of the determination result by the first determination means and the determination result by the second determination means.

[Claim 6] The mobile communication terminal according to claim 1, characterized in that:

the external connector comprises a USB (Universal Serial Bus) terminal and an additional terminal;

the plurality of kinds of first interfaces include a USB slave interface having a USB slave function and a general-purpose external interface different from the USB slave interface;

the first determination means has a function for determining whether the external device connected to the external connector incorporates a USB host interface having a USB host function; and

the interface selecting means selects the USB slave interface when the first determination means determines that the external device incorporates the USB host interface, and the general-purpose external interface when it determines that the external device does not incorporate a USB host interface.

[Claim 7] The mobile communication terminal according to claim 6, characterized in that:

when the USB slave interface is selected, the mobile communication terminal conducts signal transmission between itself and the external device via the USB terminal of the external connector; and

when the general-purpose external interface is selected, the mobile communication terminal conducts signal transmission between itself and the external device by selectively using a part of the USB terminal of the external connector and the additional terminal.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a mobile communication terminal for use in a mobile communication system in which, for example, the W-CDMA (Wideband-Code Division Multiple Access) scheme is adopted.

[0002]

[Prior Art]

As a scheme for realizing a next generation portable telephone system, the W-CDWM scheme is standardized and development is conducted on a various types of communication devices used in this type of system.

[0003]

For example, there is proposed that a connector attached with a USB (Universal Serial Bus) terminal is provided on a mobile communication terminal. When the USB interface is used as an external connection interface, the mobile communication terminal can be simply connected to a personal computer. Furthermore, an external device such as a BT (Bluetooth) unit, a memory card, a keyboard or the like can be simply connected to the mobile communication

terminal. Then, it becomes possible to appropriately expand a function of the mobile communication terminal by transmitting control data such as a telephone book or the like from the personal computer to the terminal of the mobile telephone to register the data in package and selectively using various external devices in accordance with the need thereof.

[0004]

However, in the case where a signal is transmitted between a plurality of devices by using the USB interface, it is necessary to provide a USB host function on at least one of the devices. Such USB host function has a large processing load. Consequently, it is general that such USB host function is provided on a device having a high processing capability such as a personal computer or the like while a USB slave function is provided on peripherals such as a keyboard, a mouse or the like and small size devices such as a mobile communication terminal. In such structure, when an attempt is made to connect an external device such as BT (Bluetooth) unit, a memory card, a keyboard or the like to the mobile communication terminal, connection using the USB function cannot be realized because both have only the USB slave function.

[0005]

In order to settle this problem, the USB host function may be provided on the mobile communication terminal. However, in such a structure, it is necessary to provide a

large capacity memory and a CPU having a high processing capability on the mobile communication terminal, so that an increase in the consumption power and an increase in cost of the mobile communication terminal are invited.

[0006]

On the other hand, it is thought that other universal interface such as a serial interface or the like is provided instead of providing the USB host function on the mobile communication terminal. In such a structure, it becomes unnecessary to provide a large capacity memory and a CPU having a high processing capability on the mobile communication terminal. However, apart from the connector having the USB terminal, it is necessary to provide a connector for a serial data interface, which constitutes a large hindrance in an attempt to decrease the size of the mobile communication terminal.

[0007]

[Object of the Invention]

As described above, the mobile communication terminal for W-CDMA which has been developed cannot be USB-connected to an external device. To realize USB connection, the mobile communication terminal must have a large capacity memory or a CPU having a high processing capability. Alternatively, a connector for serial interface must be provided in addition to a connector having a USB terminal, the mobile communication terminal inevitably has the drawbacks of large power consumption, high cost and an

increase in size.

[0008]

An object of the present invention is to provide a power-saving, low-cost and compact mobile communication terminal which allows a connection with an external device without providing a large capacity memory, a CPU having a high processing capability and a plurality of types of connectors.

[0009]

[Means for Achieving the Object]

To achieve the above object, a first invention provides a mobile communication terminal comprising: one kind of external connector having a predetermined terminal arrangement structure; a plurality of kinds of first external interfaces sending and receiving a signal to and from an external device in accordance with different protocols via the external connector; first determination means; and interface selecting means. The first determination means determines the type of a second external interface incorporated in the external device connected to the external connector. The interface selecting means selects an external interface corresponding to the second external interface incorporated in the external device from the plurality of kinds of first external interfaces based on a determination result of the first determination means.

[0010]

More specifically, voltages output from specified terminals of a plurality of external devices which are assumed to be connected are set to be different values, and when an external device is connected to the external connector, the first determination means detects the value of the voltage output from the specified terminal of the external device via the corresponding terminal of the external connector, and determines the type of the second external interface incorporated in the external device based on the detection result.

[0011]

Therefore, according to the first invention, every time an external device is connected, the type of the external interface incorporated in the external device is determined. Based on the determination result, the corresponding one is selected from the plurality kinds of first external interfaces and used. Therefore, whatever kind of external interface incorporated in the external device can be connected to the terminal itself.

[0012]

Further, all the plurality of kinds of first external interfaces transmit a signal via the common external connector. Therefore, it is unnecessary to provide connectors to individual external interfaces. As a result, the mobile communication terminal can be compact.

[0013]

A second invention further comprises, in addition to the structural elements of the first invention, second determination means and connection control means. The second determination means conducts an authentication procedure between the mobile communication terminal and an external device via the first external interface selected by the interface selecting means, and determines a connection status of the external device to the mobile communication terminal itself based on the authentication result. Based on the determination result of the second determination means, connection control means controls connection of the external device to the mobile communication terminal itself.

[0014]

More specifically, the second determination means sends and receives a signal to and from the external device via the first external interface selected by the interface selecting means, thereby detecting a type and a specification of the external device, and determines whether or not the external device can be connected to the mobile communication terminal itself based on the detection result.

[0015]

Therefore, according to the second invention, a connection status of the external device to the mobile communication terminal itself is determined based on the

result authentication with respect to the external device. For example, it is determined whether the external device can be connected to the terminal itself based on the type and the specification of the external device. For this reason, if the external device has an adaptable external interface but the specification thereof or the like is not adaptable, the mobile communication terminal is controlled to reject the connection of the external device. Thus, connection of the external device is always highly reliable.

[0016]

Further, the first and second inventions are characterized in that at least one of the determination result by the first determination means and the determination result by the second determination means is displayed on display means.

[0017]

With this structure, the user of the mobile communication terminal can confirm the kind of the external interface incorporated in the external device or the connection status of the external device to the terminal itself. Therefore, if the external device is a device that cannot be connected, the user can recognize that.

[0018]

An embodiment of the first invention may have the following structure. The external connector comprises a USB and an additional terminal. The plurality of kinds of first interfaces include a USB slave interface having a USB

slave function and a general-purpose external interface different form the USB slave interface. The first determination means determines whether the external device connected to the external connector incorporates a USB host interface having a USB host function. The interface selecting means selects the USB slave interface when the first determination means determines that the external device incorporates the USB host interface, and the general-purpose external interface when it determines that the external device does not incorporate a USB host interface.

[0019]

At that time, when the USB slave interface is selected, the mobile communication terminal conducts signal transmission between itself and the external device via the USB terminal of the external connector. On the other hand, when the general-purpose external interface is selected, the mobile communication terminal conducts signal transmission between itself and the external device by selectively using a part of the USB terminal of the external connector and the additional terminal.

[0020]

With the above structure, if the external device is a device having a USB host function, for example, a personal computer, the USB slave interface is selected and USB connection is carried out. On the other hand, if the external device is a device having no USB host function,

for example, a BT unit, a memory card or a keyboard, the general-purpose interface such as a serial interface is selected and connection is carried out. Therefore, the mobile communication terminal need not have a USB host interface. As a result, neither a large capacity memory nor a CPU having a high processing capability is required. Consequently, an increase in power consumption and cost of the mobile communication terminal can be prevented.

[0021]

Moreover, one connector having a USB terminal is used in both cases where the USB connection is selected and the other general-purpose external interface is selected. For this reason, for example, a connector for serial interface need not be provided in addition to the connector having the USB terminal. Consequently, the mobile communication terminal can be compact.

[0022]

[Embodiments of the invention]

An embodiment of the present invention will now be described with reference to the drawings.

FIG. 1 shows an embodiment of a mobile communication terminal of the present invention. On the mobile communication terminal according to the embodiment, there are provided a host CPU 1, a USB interface 2, a serial control signal interface 3, a switching circuit 4 and a system connector 5 as constituent elements required for the connection with the external device.

[0023]

Out of the constituent elements, in the beginning, the system connector 5 is provided for connecting the external device not shown to the terminal of the mobile communication terminal itself. The system connector 5 has a total of eleven terminals (pins) P1 through P10, and PRF. FIG. 2 shows the name and the function of these pins P1 through P1 and PRF.

[0024]

Out of eleven pins P1 through 10 and PRF, pins P1 through P4 are used for USB connection. Out of the pins, P2 and P3 are USB data transmission pin USBD+ and USBD-, so that data is transmitted in bi-directional manner between the mobile communication terminal and the external device not shown via these pins. Furthermore, P4 is a USB power source input pin, so that the USB power source voltage (4.75 through 5.25V) supplied from the external device is input. Incidentally, P1 is a USB grounding pin.

[0025]

Besides, out of the eleven pins P1 through P10, PRF, pins P5 and P6 are power source input pins for charging to supply the charging voltage and current supplied from the charger which is one of the external device to a battery circuit not shown. The pin P7 is a synchronizing clock output pin to output a synchronizing clock (64 kHz) to the external device at the time of synchronizing communication with the external device. Incidentally, the electric

condition of this synchronizing clock output pin P7 is CMOS2V±0.2V. When the pin P7 is not used, the pin P7 is set to a high impedance (200 kΩ or more).

[0026]

Furthermore, pins P8 and P9 are manufacturer's option pin and a reservation pin, respectively. In this embodiment, by using these pins P8 and P9, serial data is transmitted between the mobile communication terminal and the external device. Incidentally, the electric condition of the manufacturer's option pin is defined so that the input voltage is set to be 3.6V or less. When the pin P8 is not used, the pin P8 is set to a high impedance (200 kΩ or more).

[0027]

The USB interface 2 comprises a USB device controller 21, and a detection circuit 22. The USB device controller 21 has a slave function of the USB interface and transmits data via the USB data transmission pins P2 and P3 between the mobile communication terminal device and the external device such as a personal computer or the like having a USB host function.

[0028]

The detection circuit 22 incorporates the interface identification voltage supplied from the external device via the USB power source input pin P4 of the system connector 5 to detect the voltage value. In this embodiment, the value of the interface identification

voltage generated by the external device having no USB host function is set in advance to a value different from the USB power source voltage (4.75 through 5.25V) at which the external device having a USB function is generated. The detection circuit 22 detects these voltage values respectively to give the detection result to the host CPU 1.

[0029]

The serial control signal interface 3 sends and receives the serial control signal at the time of transmitting the signal using the serial data interface between the external device and the mobile communication terminal device. In this embodiment, the serial control signal is transmitted via the USB data transmission pins P2 and P3 of the system connector 5.

[0030]

The host CPU 1 is attached with a serial data interface 11. This serial data interface 11 sends and receives the serial data at the time of transmitting the signal using the serial data interface between the external device and the mobile communication terminal. In this embodiment, this serial data is transmitted by using the manufacturer's option pin P8 and the reservation pin P9 of the system connector 5.

[0031]

By the way, a switching circuit 4 is provided between the system connector 5 on one hand and the USB interface 2,

the serial control signal interface 3, and the serial data interface 11 in the host CPU 1 on the other. The switching circuit 4 has a first and a second change-over switch 41 and 42. The first and the second change-over switch 41 and 42 are associated with each other in accordance with the change-over control signal generated from the host CPU 1 to operate switching operation.

[0032]

The first change-over switch 41 optionally changes over and connects the USB device controller 21 and the serial control signal interface 3 with respect to the USB data transmission pins P2 and P3 of the system connector 5. On the other hand, the second change-over switch 42 turns on and off the connection of the serial data interface 11 with respect to the manufacturer's option pin P8 and the reservation pin P9 of the system connector 5.

[0033]

As a new function which is concerned with the present invention, the host CPU 1 comprises first determination means 1a, interface selection control means 1b, second determination means 1c and connection control means 1d.

[0034]

Out of these means, in the beginning, the first determination means 1a incorporates a detection value of the interface identification voltage from the detection circuit 22 of the USB interface 2 when the external device is connected to the system connector 5. Then, it is

determined whether or not the external device which is connected has a USB host function on the basis of the detection value of the interface identification voltage.

[0035]

The interface selection control means 1b gives the change-over control signal SWC to the switching circuit 4 on the basis of the determination result by the first determination means 1a. Then, in the case where it is determined that the external device has a USB host function, the USB device controller 21 is connected to the USB data transmission pins P2 and P3 with the first change-over switch 41. Besides, at the same time, the connection between the serial data interface 11, the manufacturer's option pin P8 and the reservation pin P9 is set to the OFF state with the second change-over switch 42. On the other hand, in the case where it is determined that the external device does not have the USB host function, the serial control signal interface 3 is connected to the USB data transmission pins P2 and P3 with the first change-over switch 41. Furthermore, at the same time, the connection between the serial data interface 11, the manufacturer's option P8 and the reservation pin P9 is set to the ON state with the second change-over switch 42.

[0036]

The second determination means 1c sends an ID request command to the external device via the USB device controller 21 or the serial control signal interface 3 in

the state in which each of the interfaces 2, 3, 11 and the system connector 5 are selectively connected with the control of the interface selection control means 1b. Then, when the device ID and the manufacturer ID are sent from the external device, the type of the external device and the specification thereof which is different from one manufacturer to another are determined on the basis of these device ID and the manufacturer ID.

[0037]

The connection control means 1d determines on the basis of the determination result of the second determination means 1c whether or not the external device which is connected is a device which can be connected to the terminal of the mobile communication terminal itself. If the external device cannot be connected thereto, the connection between the system connector 5 and the main body of the terminal is electrically separated.

[0038]

An operation of the mobile communication terminal, which is constituted in the manner described above, is explained by using the flowchart shown in FIG. 3.

Incidentally, here an explanation will be made on a case in which a personal computer PC having a USB host function is connected to the mobile communication terminal MS and a case in which a memory card having no USB host function is connected to the PC respectively.

[0039]

(1) In the case where the personal computer PC is connected to the mobile communication terminal

Suppose that a personal computer PC is connected to a mobile communication terminal device MC via a USB cable 7 in the state in which the power source is turned on. Then, at step 4a, the personal computer PC generates the USB power source voltage (4.75 to 5.25V) with the voltage generator 62. This USB power source voltage is supplied to the mobile communication terminal MS via the USB cable 7 and the USB power source pin P4 (VBUS) to be input to the detection circuit 22 in the USB interface 2. When the detection circuit 22 detects the input of the power source voltage, an interruption signal is given to the host CPU 1.

[0040]

After the host CPU 1 of mobile communication terminal MS conducts initialization at step 3a, the host CPU 1 monitors the input of the interruption signal at step 3b. Then, when the interruption signal is input from the detection circuit 22 in this state, the host CPU 1 determines that the external device is connected to the system connector 5, so that the voltage detection value is input from the detection circuit 22 at step 3c. Then, the CPU 1 determines whether or not the external device has a USB host function on the basis of the voltage detection value at step 3d.

[0041]

For example, when the voltage detection value is the USB power source voltage (4.75 to 5.25V), it is determined that the external device which is connected is a device having a USB host function. In contrast, the voltage detection value is a voltage (for example, 2V) other than the USB power source voltage (4.75 to 5.25V), it is determined that the external device which is connected is a device having no USB host function.

[0042]

By the way, when the type of the external interface incorporated in the external device is determined, the host CPU 1 conducts the change-over control of the switching circuit 4 at step 3e on the basis of the determination result thereof. For example, now, the personal computer PC having the USB host function is connected as an external device. Consequently, the host CPU 1 changes over the first change-over switch 41 to the side of the USB device controller 21. Furthermore, at the same time, the CPU 1 turns off the second change-over switch 42 to set the serial data interface 11 to the no-connection state with respect to the manufacturer's option pin P8 and the reservation pin P9 of the system connector 5.

[0043]

Subsequently, the host CPU 1 moves to step 3f to create the ID request command here to send this ID request command to the personal computer PC via the USB device

controller 21. The personal computer PC monitors the arrival of the ID request command at step 4b as shown in FIG. 3. In this state, when the ID request command comes from the mobile communication terminal MS, the device ID indicating the type of the device itself and the manufacturer ID are generated to send the device ID and the manufacturer ID to the mobile communication terminal MS.

[0044]

The host CPU 1 of the mobile communication terminal MS monitors the arrival of the ID at step 3g after sending the ID request command. When the device ID and the manufacturer ID are received in this state, the external device database not shown is accessed on the basis of the device ID and the manufacturer ID at step 3h to determine the type and the specification of the external device. Then, on the basis of the determination result, at step 3i, the external device determines whether or not the external device can be connected to the mobile communication terminal MS itself. Then, in the case where the external device can be connected thereto, the connection port between the system connector 5 and the main body of the terminal is set to the effective state.

[0045]

Thus, the mobile communication terminal MS and the personal computer PC are connected via the USB interface, so that data transmission control by the upper protocol is made possible between the two devices.

[0046]

(2) When the memory card ES is connected to the mobile communication terminal

Suppose that the memory card ES is connected to the mobile communication terminal MS via the cable 9 corresponding to the system connector as shown in FIG. 5. Then, at step 4a, the memory card ES generates a power source voltage (3V) which is set to be different from the USB power source voltage (4.75 to 5.25V) with a voltage generator 82 provided for generating an interface identification voltage.

[0047]

The interface identification voltage is supplied to the mobile communication terminal MS via the cable 9 and the USB power source pin P4 (VBUS) to be input to the detection circuit 22 in the USB interface 2. When the detection circuit 22 detects the input of the interface identification voltage, the interruption signal is given to the host CPU 1.

[0048]

When the CPU 1 of the mobile communication terminal MS detects the generation of the interruption at step 3b, it is determined that the external device is connected to the system connector 5. Then, after the voltage detection value is detected from the detection circuit 22, it is determined whether or not the external device has a USB host function at step 3d on the basis of the voltage

detection value. Now, since the voltage is set to a value (2V) other than the USB power source voltage (4.75 to 5.25V), it is determined that the external device which is connected is a device having no USB host function.

[0049]

Then, when the type of the external interface incorporated in the external device is determined, the host CPU 1 conducts the change-over control of the switching circuit 4 at step 3e on the basis of the determination result thereof. For example, now a memory card ES having no USB host function is connected as the external device. Therefore, as shown in FIG. 5, the host CPU 1 is changed over the first change-over switch 41 to the side of the serial control signal interface 3. Furthermore, at the same time, the second change-over switch 42 is turned on to connect the serial data interface 11 to the manufacturer's option pin P8 and the reservation pin P9 of the system connector 5.

[0050]

Subsequently, the host CPU 1 moves to step 3f to create the ID request command here. Then, this ID request command is sent to the memory card ES via the serial control signal interface 3. The memory card ES monitors the arrival of the ID request command at step 4b as shown in FIG. 3. When the ID request command arrives from the mobile communication terminal device MS in this state, the device ID and the manufacturer ID are created at step 4c,

and the device ID and the manufacturer ID are sent to the mobile communication terminal MS.

[0051]

The host CPU 1 of the mobile communication terminal MS monitors the arrival of the ID at step 3g after sending the above ID request command. When the device ID and the manufacturer ID are received in this state, the external device database not shown is accessed on the basis of the device ID and the manufacturer ID at step 3h to determine the type and the specification of the external device. Then, on the determination result, it is determined at step 3i whether or not the external device can be connected to the terminal of the mobile communication terminal MS itself. Then, in the case where it is determined that the external device can be connected thereto, the connection port between the system connector 5 and the main body of the terminal is set to the effective state.

[0052]

Thus, the mobile communication terminal MS and the memory card ED are connected via the serial control signal interfaces 3 and 81 and the serial data interfaces 11 and 83. Then, the serial data can be transmitted by the upper protocol between the two devices.

[0053]

In contrast, in the case where it is determined on the basis of the determination result of the type of the external device and the specification thereof that the

external device cannot be connected to the communication terminal MS, the connection port between the system connector 5 and the main body of the terminal is set to the cut-off state. Consequently, in the case where the external device which does not conform to the specification of the mobile communication terminal MS is connected thereto, the connection of the external device is cut off so that an unfavorable influence of the external device to the mobile communication terminal MS is prevented in advance.

[0054]

As has been described above, in this embodiment, the serial control signal interface 3 and the serial data interface 11 are provided in addition to the USB interface 2 having the USB device controller 21 in the mobile communication terminal MS while a switching circuit 4 is provided for selectively connecting these interfaces to the system connector 5. Then, when the external device is connected to the system connector 5, it is determined whether or not the external device has an external interface having the USB host function on the basis of the interface identification voltage supplied from the external device to change over and control the switching circuit 4 on the basis of the determination result and select an appropriate external interface.

[0055]

Consequently, the USB interface 2 is selected and data

is transmitted using the USB interface in the case where the external device which is connected is a personal computer having the USB host function while the serial control signal interface 3 and the serial data interface 11 are selected to transmit data using a universal serial interface in the case where the external device is a slave device such as a memory card ES or the like having no USB host function.

[0056]

That is, even when the mobile communication terminal has no USB host function, data can be transmitted by selectively connecting a plurality of types of external devices having different external interfaces so that the mobile communication terminal MS can be maintained at low power consumption and low cost.

[0057]

Besides, in this embodiment, the USB interface and the serial interface are selectively connected with respect to one serial connector 5. That is, one serial connector 5 is shared with the USB interface and the serial interface. As a consequence, it is not necessary to newly provide a serial interface connector so that an increase in the size of the mobile communication terminal can be prevented.

[0058]

Furthermore, in this embodiment, the device type of the external device and the name of the manufacturer thereof, namely, the specification thereof is determined by

conducting authentication procedure between the external device which is connected and the mobile communication terminal to determine whether or not the external device can be connected to the terminal of the mobile communication terminal itself. Then, when it is determined that the external device cannot be connected thereto, the external device is set to the non-connection state.

Consequently, even when the external device having different specification is connected, a disadvantage can be prevented in advance in that the mobile communication terminal causes an error in operation or trouble in some cases with the external device.

[0059]

This effect is particularly effective in the case where a charger is connected thereto as the external device. That is, when the rated value of the voltage/current of the connected charger is different from the standard value of the mobile communication terminal, it sometimes happens that the device is heated or catches fire, which is extremely unfavorable. Therefore, in this embodiment, when the charger as the external device is connected, the device ID and the manufacturer ID of the charger obtained in the authentication procedure are determined so that the charger can not be connected, the charging power source input pins P5 and P6 and the power source circuit in the portable communication terminal are cut off to prevent the charging thereof. Consequently,

even when a charger having a different standard is connected, heating and fire can be prevented with certitude.

[0060]

Incidentally, the present invention is not limited to the above embodiment. For example, the present embodiment has a USB interface having a USB slave function and a universal serial interface to constitute a structure in which the external interface is selected in accordance with the type of the external interface incorporated in the external device which is connected. However, the present invention may not necessarily limited thereto. The present invention may comprise a plurality of types of external interfaces such as RS232C, SPI, I2BUS, IEEE1394 to select these external interfaces in accordance with the types of the external interface incorporated in the external device.

[0061]

Furthermore, in the above embodiment, there has been explained a case in which an USB interface having the USB slave function is provided on the mobile communication terminal MS. However, the invention may be constituted in such a manner that a simple host function of USB which is constituted so that processing addition becomes smaller than the USB host function provided on the external device having a high processing capability or the like such as, for example, a personal computer or the like.

With such a structure, it becomes possible to transmit data using the USB interface between the terminal of the mobile communication terminal and a majority of external devices having only USB slave function without increasing a memory capacity of the mobile communication terminal MS and a processing capability of the CPU.

[0062]

Furthermore, in the above embodiment, there has been explained a case in which the type of the external interface incorporated in the external device is determined on the basis of the interface identification voltage generated by the external device. However, the invention may be constituted in such a manner that the type of the external interface is determined by supplying one bit or two bits identification signal instead of the interface identification voltage so that the type of the external interface is determined by supplying the identification signal to a specific connector pin of the mobile communication terminal from the external device.

[0063]

Apart from it, with respect to the structure of the first and the second determination means and the determination content, the structure of the interface selection means, the structure of the connection control means, the type of the external device, the type of the external interface and the like can be modified in various ways without departing from the gist of the invention.

[0064]

[Advantage of the Invention]

As has been described above, according to the present invention, a mobile communication terminal, including one type of connector for external connection having a predetermined terminal arrangement structure, contains a plurality of types of first external interfaces sending and receiving a signal in accordance with different protocols via the connector for external connection to and from an external device. It also contains first determination means and interface selection means. The first determination means determines the type of a second external interface which the external device connected to the connector for external connection has. Based on the determination result, the interface selection means selects from the plurality of types of first external interfaces an external interface corresponding to the second external interface that the external device has.

[0065]

Therefore, according to the present invention, an external device can be connected without providing a large capacity memory, a CPU having a high processing capability and a plurality of types of connectors. As a result, a power-saving, low-cost and compact mobile communication terminal can be provided.

[Brief Description of the Drawings]

[FIG. 1]

A structural diagram showing an essential portion of one embodiment of a mobile communication terminal according to the present invention.

[FIG. 2]

A view showing a name and a function of each pin of a system connector provided on the mobile communication terminal shown in FIG. 1.

[FIG. 3]

A flowchart showing a connection control procedure of the mobile communication terminal shown in FIG. 1 and the external device connected to the mobile communication terminal and a content of the connection procedure.

[FIG. 4]

A view showing a connection structure in the case where a personal computer having a USB host function is connected to the mobile communication terminal shown in FIG. 1 as the external device.

[FIG. 5]

A view showing a connection structure in the case where a memory card without the USB host function is connected to the mobile communication terminal shown in FIG. 1 as the external device.

[Explanation of Reference Symbols]

MS ... mobile communication terminal

PC ... personal computer

ES ... memory card

1 ... host CPU of the mobile communication terminal

1a ... first determination means

1b ... interface selection control means

1c ... second determination means

1d ... connection control means

2 ... USB interface

3, 81 ... serial control signal interfaces

4 ... switching circuit

5 ... system connector

6 ... host CPU of a personal computer

7 ... USB cable

8 ... host CPU of the memory card

11, 83 ... serial data interfaces

21 ... USB device controller

22 ... detection circuit for interface identification voltage

41 ... first change-over switch

42 ... second change-over switch

61 ... USB host controller

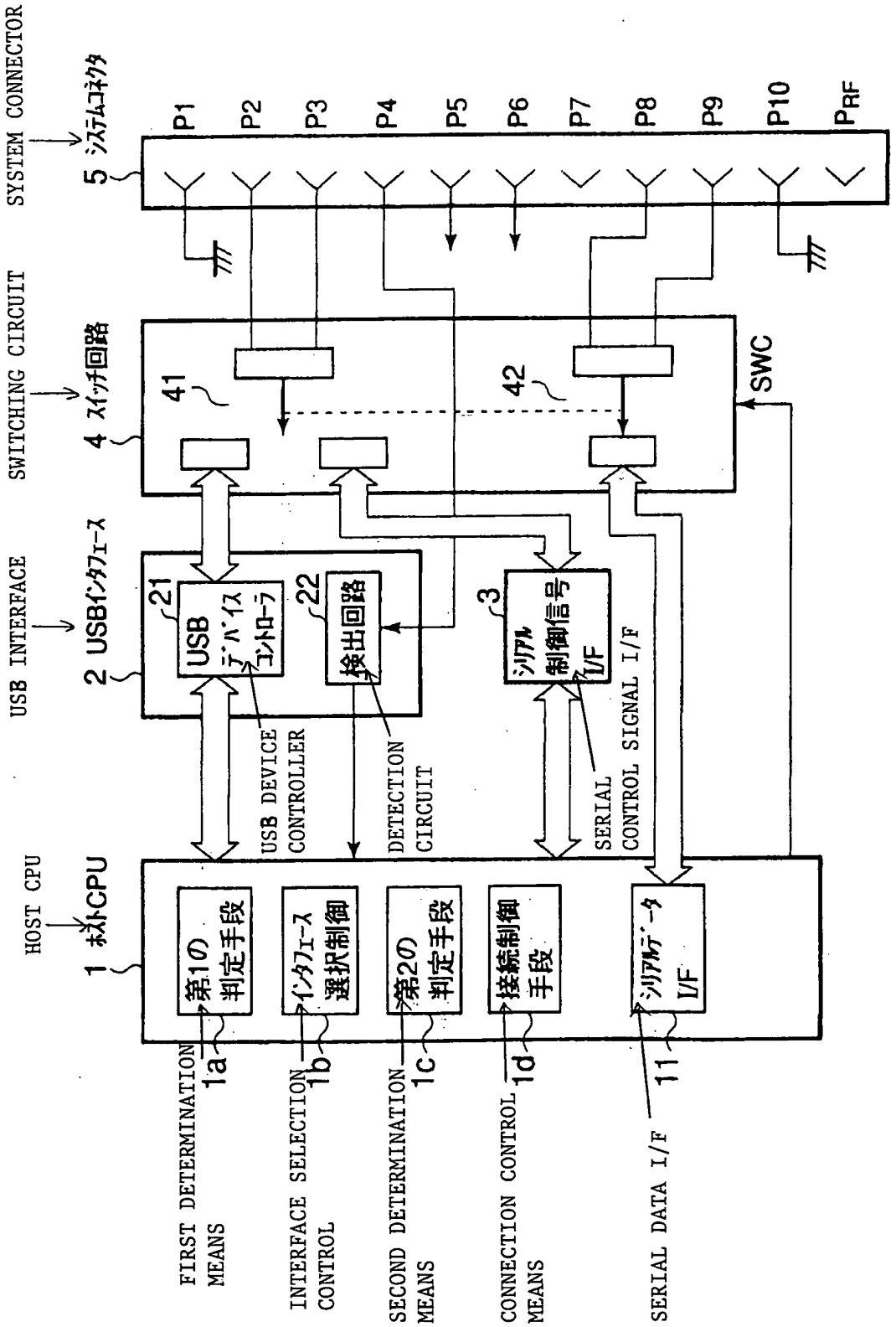
62, 82 ... voltage generators

NAME OF DOCUMENT

【書類名】 図面 DRAWINGS

【図１】

FIG. 1



【図２】
FIG. 2

ARRANGEMENT OF SYSTEM CONNECTOR PIN
システムコネクタピン配置

SIGNAL TRANSMISSION DIRECTION
信号転送方向

MOBILE COMMUNICATION TERMINAL
携帯通信端末

EXTERNAL DEVICE
外部機器

PIN NUMBER
ピン番号

NAME
名称

REMARKS
備考

ピン番号	名称	信号転送方向	備考	
P1	GND(USBGND)	———	USB規格1.1準拠	CONFORMS TO USB STANDARD 1.1
P2	USB D+	⟺	USB規格1.1準拠	
P3	USB D-	⟺	USB規格1.1準拠	
P4	USB VBUS	←	USB規格1.1準拠	
P5	充電用電源入力ピン	←	充電用	FOR USE IN CHARGING
P6	充電用電源入力ピン	←	充電用	
P7	同期クロック出力ピン	→	同期クロック出力用	FOR SYNCHRONIZING CLOCK OUTPUT
P8	製造者オプションピン	⟺	製造者オプション用	FOR MANUFACTURE'S OPTION
P9	予約ピン	Not Connected	予約用	FOR RESERVATION
P10	GND	———	グランド	GROUND
P_{RF}	RF TRX	⟺	同軸(外部アンテナ)接続用	FOR COAXIAL (EXTERNAL ANTENNA CONNECTION)

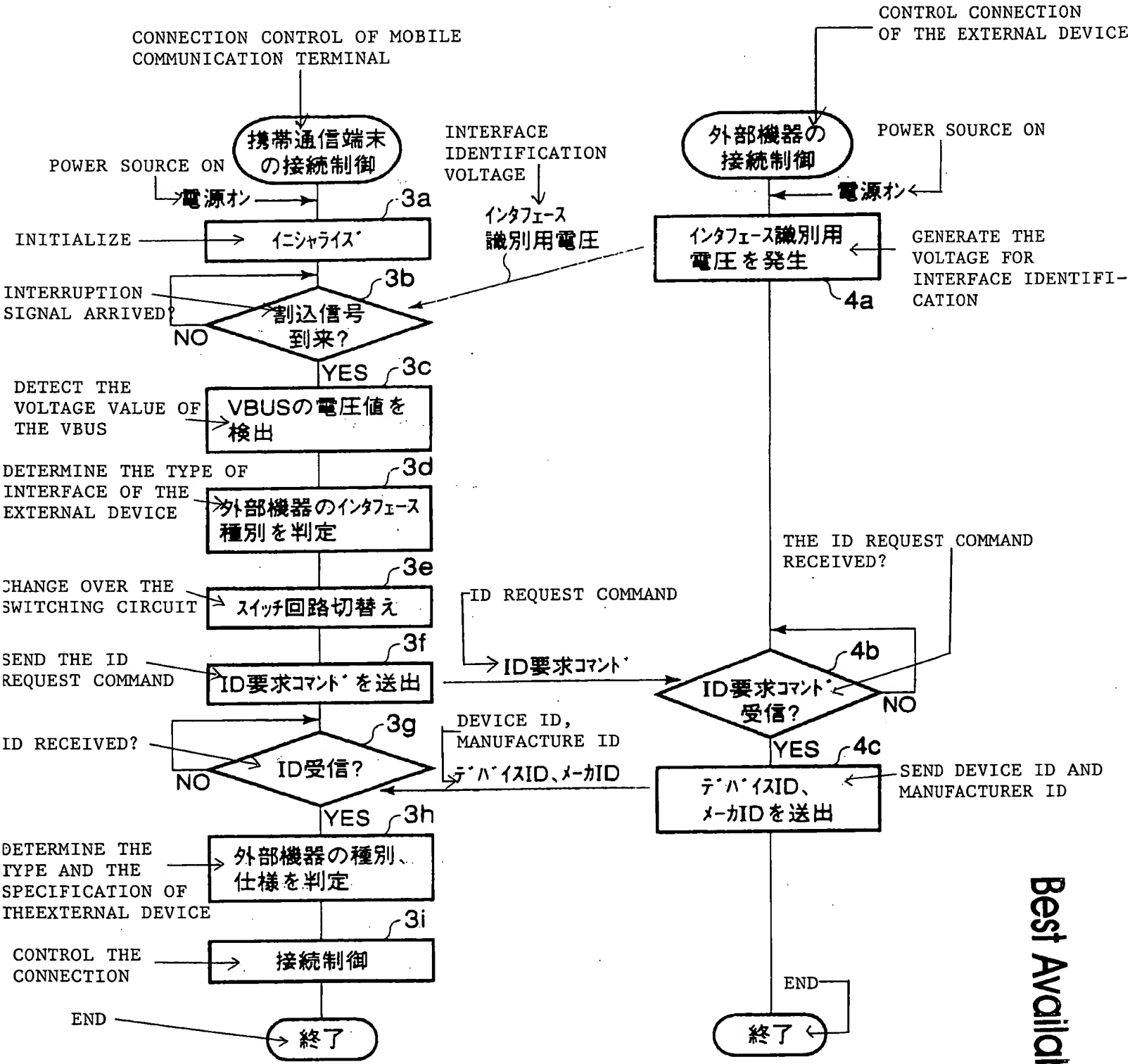
CHARGING POWER SOURCE INPUT PIN

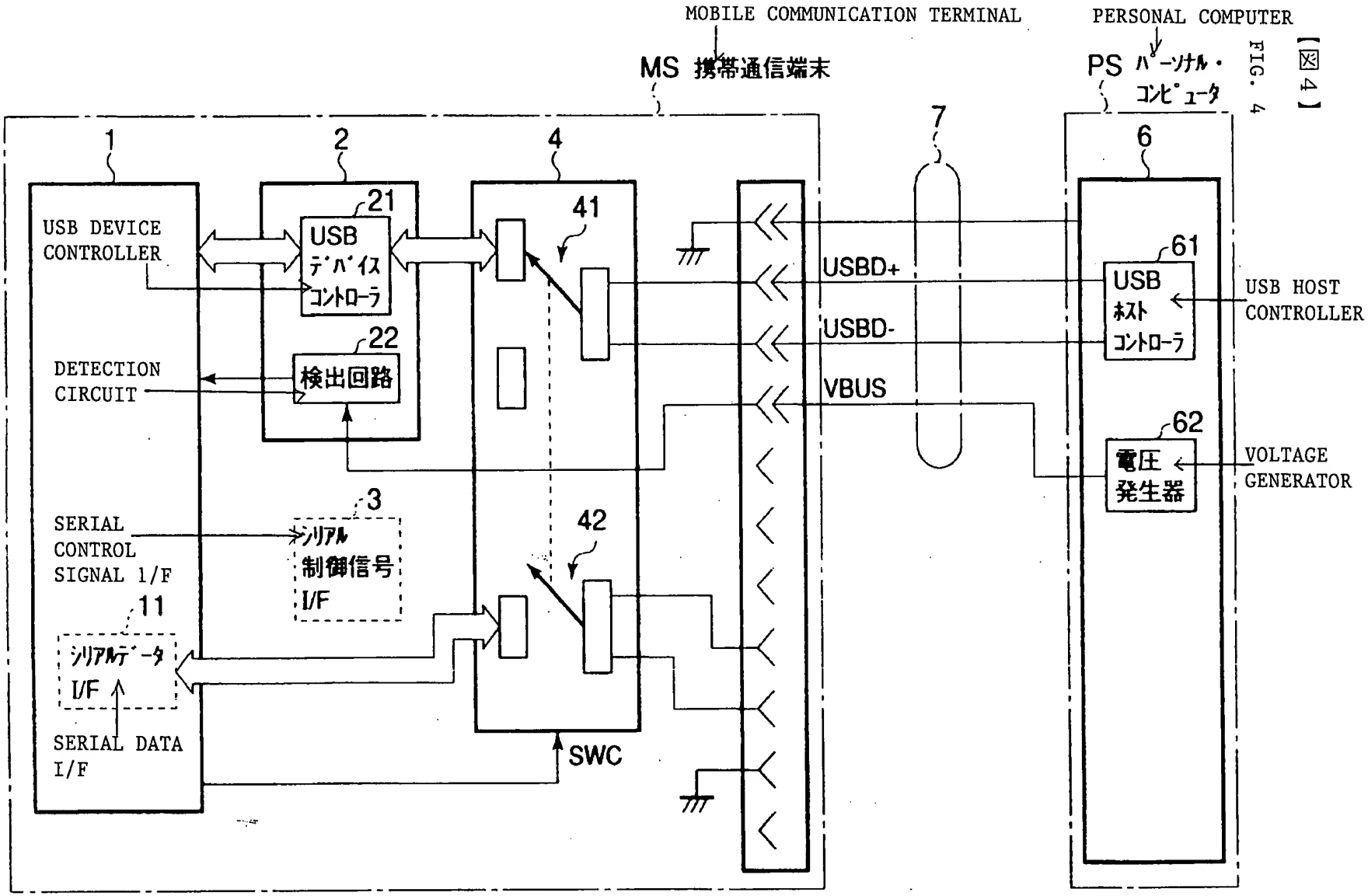
SYNCHRONIZING CLOCK OUTPUT PIN

MANUFACTURE'S OPTION PIN

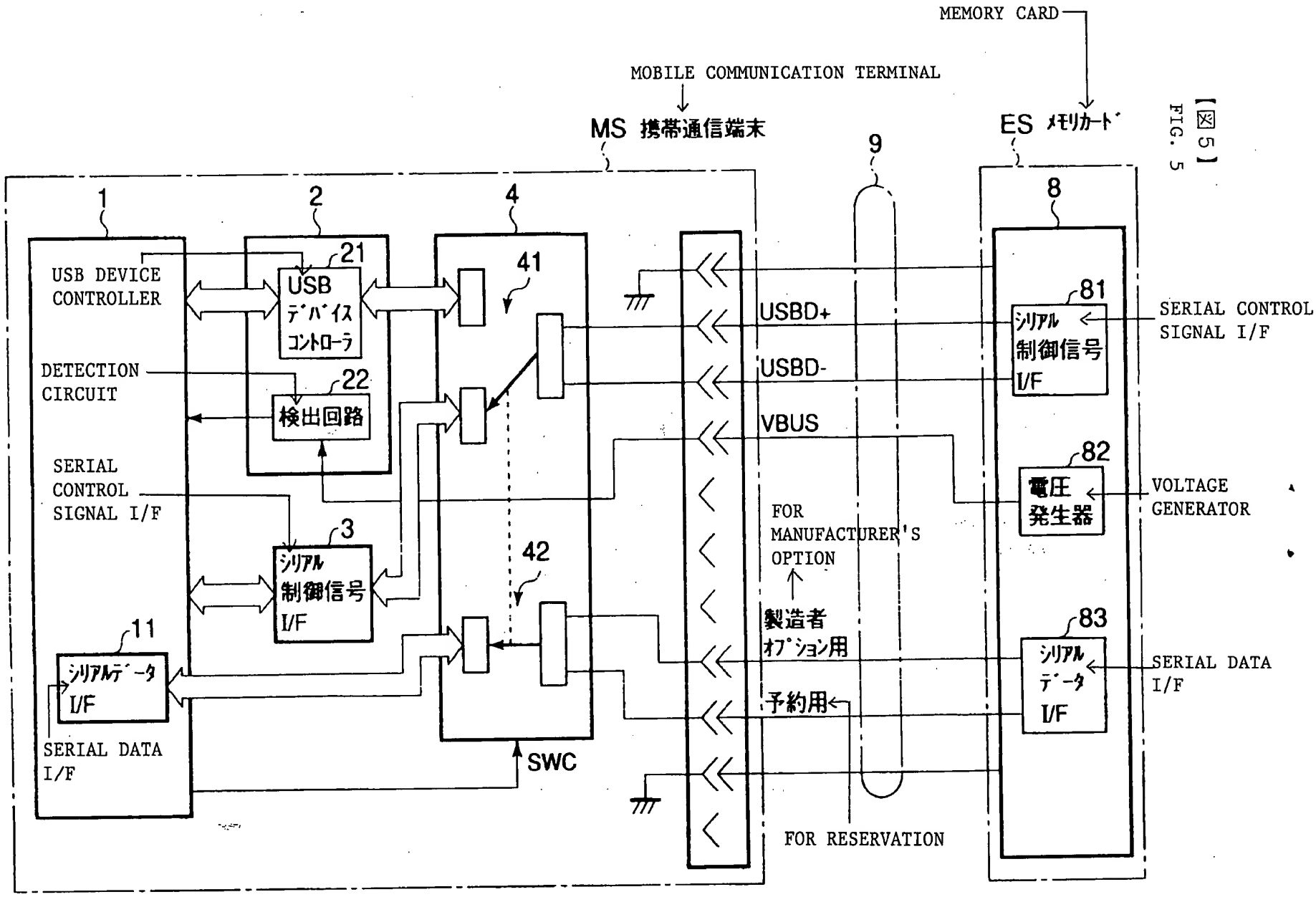
RESERVATION PIN

【図３】 FIG. 3





【図4】
FIG. 4



【図5】
FIG. 5

[Document] ABSTRACT

[Abstract]

[Object] To provide a power-saving, low-cost and compact mobile communication terminal, which can be connected to an external device without providing a large capacity memory, a CPU having a high processing capability and a plurality of types of connectors.

[Means for Achieving the Object] A serial control signal interface 3 and a serial data interface 11 are provided in addition to a USB interface 2 having a USB device controller 21 in the mobile communication terminal MS while a switching circuit 4 is provided for selectively connecting these interfaces to a system connector 5. Then, when an external device is connected to the system connector 5, it is determined whether or not the external device has an external interface having a USB host function on the basis of a interface identification voltage supplied from the external device to change over and control the switching circuit 4 on the basis of the determination result and select an appropriate external interface.

[Elected Figure] FIG. 1